## SESSION VI
## $P^2$ IN PAINTING OPERATIONS

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# ISSUES IDENTIFIED DURING THE AETC AIRCRAFT PAINT REGIONALIZATION STUDY

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## ABSTRACT

The 1990 passage of the Clean Air Act Amendments applied new emission requirements to several source categories of Hazardous Air Pollutants (HAPs). The National Emission Standards for Hazardous Air Pollutants (NESHAP) for Aerospace Manufacturing and Rework Facilities, commonly called Aerospace NESHAP, raised concern in the Air Force that major aircraft paint facility modifications may be necessary. The question the Air Education and Training Command (AETC) Logistics staff wanted answered was "What requirements will be imposed on our aircraft maintenance facilities to bring them into compliance with the new rule?"

The Headquarters AETC Logistics and Civil Engineering offices set out to work together to clarify the command requirements. A three-prong approach was used. (1) Update the command base air emission inventories for stationary sources using the latest regulatory guidance. (2) Evaluate all base level paint and depaint facilities in addition to all maintenance operations using volatile organic solvents. Finally, (3) perform an operational needs analysis using lifecycle cost business method to evaluate alternative solutions.

The ongoing Environmental Protection Agency regulatory clarifications and the continuing evaluation of AETC painting operations led to the eventual narrowing of the required compliance actions. During the course of the aircraft corrosion control facility analysis AETC began identifying whether adequate capacity existed for current aircraft corrosion control maintenance requirements. The aircraft painting capacity analysis identified that a capacity shortfall existed, but had never been identified by the base level corrosion shops. An Audit Agency review of the AETC plastic bead blasting facilities identified an excess of capacity. The challenge became how to find the most economical solution to satisfy the operational requirements.

### Background

The Clean Air Act (CAA) amendment for Aerospace NESHAP focused on aircraft maintenance operations that worked on the exterior flight supporting parts of aircraft and space vehicles. The specific operations within AETC that would be affected were aircraft painting, de-painting and general solvent usage, such as in wipe-down or surface cleaning operations. The Aerospace

NESHAP applies to facilities that are a major source of HAPs. The details of the Aerospace NESHAP rule may be found in 40 CFR 63 Subpart GG (40 CFR 63.741 – 63.753). A good summary of the rule may be found in the Pro-Act Fact Sheet, National Emission Standards for Hazardous Air Pollutants (NESHAP) for Aerospace Facilities, June 1997.

When the rule was first proposed as published in the federal register in June 1994, it appeared that it might apply to all AETC aircraft corrosion control operations and all solvent usage in any base shop. Further EPA clarification limited the solvent usage coverage to just the aircraft maintenance operations. Early estimates for AETC compliance with the rule placed the command cost at $22.9M for building or modifying 18 corrosion control facilities at ten bases. Review of the 1993 air emission inventories for AETC showed that 9 of 12 bases were major sources of HAPs based on their potential-to-emit pollutant emissions exceeding the threshold of 25 tons per year of HAPs. Based on this initial assessment the question for AETC became, 'What actions should AETC take to minimize the Aerospace NESHAP compliance costs?' HQ AETC assembled a command team to address AETC Aerospace NESHAP compliance.

Review of the available 1994 air emission inventories (AEI) HAP potential-to-emit (PTE) levels showed an increase from the 1993 AEIs. This could probably be attributed to minimal EPA guidance on how to calculate the PTE. In the first quarter of 1996 AETC contracted to have all the AETC base air emission inventories calculated for CY 1995. The 1995 AEIs showed that only four of the 13 AETC bases had exceeded the HAPs PTE major source threshold.

AETC's corrosion control facilities were 25 to 30 years old, since they had been built in the 1960s or 70s. Assuming the base aircraft paint booths had to convert to Aerospace NESHAP required VOC control and inorganic HAP filters, then it would be smart to identify all the facility deficiencies and requirements early. The AETC Aerospace NESHAP and facility review team visited the AETC bases concurrently with contractor team to collect and prepare the base air emission inventories. The facility review team looked at the paint booths for each regulatory requirement. All the paint booths looked at required some upgrade to bring them up to the current paint booth best achieveable control technology (BACT) standards.

**Paint Conversion**

In June 1997 HQ AETC/LGMTS sent out a message to the AETC base LGMs to begin conversion from high VOC paints and primers to low VOC products. The June 1997 message requested that all units identify to the HQ AETC Technology Support Section all paints and primers that the base is not aware of a suitable low VOC substitute. By December 1997 most high VOC aircraft paints and primers had suitable substitutes identified.

In December 1997 HQ AETC/LGMTS sent out a second message mandating conversion to all low VOC paints and primers. The message recommended using up remaining existing stocks of high VOC paints and primers. The message mandated that all AETC units begin using low VOC paints and primers by 1 March 1998. The message further requested that any units that would not be able to meet the 1 Mar 98 compliance date, forward identification information about the remaining materials and the projected date that such high VOC materials would be used up. One of the goals of the conversion was to use up the remaining high VOC material stocks, without having to dispose of any of the high VOC materials as hazardous wastes.

By May 1998 all the AETC aircraft and support equipment corrosion control sections had successfully converted to low VOC paints and primers. Paint conversion for all of AETC was accomplished three months in advance of the Aerospace NESHAP compliance date of 1 September 1998. This was not a problem since AETC had already converted in previous years to high volume low-pressure (HVLP) spray guns. The HVLP guns were designed to be able to apply low VOC paints and primers.

**Base Painting Capacity**

The AETC Aerospace NESHAP compliance team talked with the corrosion control shop personnel and flight chief to determine the flight's workload capacity. Workload capacity initially was based on the quantity of staff members assigned, the number of daily work shifts, and the number of assigned aircraft or support equipment that must be maintained by each base aircraft corrosion control flight.

One of the things that the AETC team discovered was that simply looking at the aircraft paint workload from the perspective of number of personnel assigned to a function or the number of shifts worked by the assigned personnel was not a good indicator of the quantity of aircraft that could be moved through their aircraft corrosion control paint booth. It became apparent that neither of these factors was directly linked with the production capability of the base corrosion control shop.

So the team then identified that they did know several factors, but the question was how to relate them all together. The solution was to settle on a new workload capacity concept element the 'Flow Day'. The flow day was the number of days that an aircraft took to move through each base corrosion control facility from the start of work to the end of work. The flow days that each base took to perform the required corrosion control work was a calculated factor. The flow day was determined by the number of clock hours (chr) used at each location to perform all the required aircraft corrosion control work for each type of aircraft along with the number of days the aircraft was in the base corrosion control facility. At some bases corrosion control only worked 1-shift days (8 hrs), while others worked 2 shift days (16 hrs). Just because one base worked 2 shifts versus 1 shift, didn't mean that an aircraft work was done any sooner. In either case the aircraft took a finite number of days to prep, paint, cure, and perform final detail. The limiting factor in facility capacity was the number of days that the aircraft was in the facility. This number of work days per aircraft in the aircraft paint hangar was defined as the number of flow days for that aircraft in that base facility. The number of flow days required for each type of aircraft also varied by base. Apparently there was also variability in the local environmental conditions (temperature, humidity, etc.) and the workforce that caused this.

Based on the way AETC performs the flying training mission, it was decided that the number of available workdays in our facilities was 232 days per year. The base corrosion control aircraft workload typically consists of three operations: touch-up painting, mid-life scuff sand and overcoat painting, and periodic full paints. The touch-up and maintenance painting occurs annually and as needed. The mid-life scuff sand and overcoat (SS&O) painting occurs mid-cycle in the aircraft paint cycle. Aircraft periodic full paint occurs at the end of the aircraft paint cycle. For example, at year three a SS&O and at year six a full paint/depaint are performed on a T-37. Some typical AETC aircraft paint cycles are shown in Table 1.

**Table 1**

| | Operation | | |
|---|---|---|---|
| **Aircraft Type** | **Touch-up** | **Scuff Sand &Overcoat Mid-cycle** | **Full Paint Full-cycle** |
| | **Period** | | |
| T-37B | Annually – 1 yr | 3 yr | 6 yr |
| T-38 | Annually – 1 yr | 3 yr | 6 yr |
| F-16 | Annually – 1 yr | 3 yr | 6 yr |
| C-17 | Annually – 1 yr | 5 yr | 10 yr |
| C-130 | Annually – 1 yr | 6 yr | 12 yr |
| C-5 | Annually – 1 yr | 7 yr | 14 yr |

**Table 2**

| **Aircraft Type** | **Quantity Assigned** | | |
|---|---|---|---|
| T-37 | 98 | | |
| **Corrosion Operations in Paint Booth/Hangar** | | | |
| **Operation Type** | **Qty Jobs / Yr** | **Flowdays / Job** | **Flowdays / Yr** |
| Touch-up | 20 | 2 | 40 |
| SS&O | 6 | 5 | 30 |
| Full Paint | 6 | 4 | 24 |
| Total T-37 Workload Requirement | | | 94 |

**Table 3**

| **Aircraft Type** | **Corrosion Control Flowdays Required** |
|---|---|
| T-37B | 94 |
| T-38 | 90 |
| T-1A | 76 |
| **Aircraft Flowday Requirement** | **260** |
| AGE / Support Equipment Req. | 24 |
| **Base Flowday Requirement** | **284** |

The frequency of the corrosion control work along with the number of assigned aircraft defined the number of corrosion control operations required annually for each aircraft type. When you combine the number of flow days each operation takes per aircraft along with the number of required operations per aircraft type, then you get the facility flowday requirements for each aircraft type.

Add up the flowday requirements for each aircraft type and you get the base flowday requirements. An AETC undergraduate pilot training (UPT) base typically has multiple aircraft types assigned, such as T-37s, T-38s and T-1s. The base corrosion control requirements for such a mix of aircraft may look something like that shown in Table 3. An additional support requirement that may use the aircraft corrosion control hangar is aerospace ground equipment (AGE) or other large support equipment. An example of the AGE or support equipment flowday requirement for the aircraft paint booth/hangar is also shown in Table 3.

The available workdays in any facility on base are 232 days as explained earlier. The base requirement in this example is 284 flowdays. Already this sample base has a shortage of 54 flowdays. In almost all cases each base in AETC had a capacity shortfall. So it was decided to identify several optional approaches to solve the AETC aircraft painting capacity shortfall..

**Regionalization**

A regionalization study was initiated to formalize the approaches that could be used to solve the AETC aircraft painting capacity shortfall. It was decided that six alternatives would be considered and assessed for their 25-year lifecycle cost. Table 4 shows the AETC regionalization study alternatives considered.

The objectives of the study were to find an alternative which would maintain/achieve regulatory compliance and meet the documented corrosion control workload. Alternative 1 could not meet these objectives, therefore, it was not considered for detailed evaluation. Alternative 2 determined that 13 new aircraft corrosion control facilities (paint bays) would be required. Alternative 3 determined that nine new aircraft corrosion control facilities (paint bays) would be required. See Table 5 for detailed capacity analysis and illustration of the new facility needs.

Alternative 4 to outsource to other USAF commands did not become a viable alternative, since, none of the other Air Force organizations contacted indicated having any available capacity or interest in the option.

**Table 4**

| | | |
|---|---|---|
| Alternative 1 | Continue current aircraft corrosion control operations in available facilities | — |
| Alternative 2 | Upgrade existing aircraft corrosion control facilities to achieve regulatory compliance and add new compliant facilities to meet documented workload at each installation | $179M |
| Alternative 3 | Regionalize within AETC | $129M |
| Alternative 4 | Maximize outsourcing AETC workload to other USAF commands | $218M |
| Alternative 5 | Maximize outsourcing to commercial facilities | $187M |
| Alternative 6 | HQ selected combination of alternatives 3, 4 and 5. | $112M |

Alternative 5 to outsource to commercial facilities did not become a viable alternative due to lack of adequate response. Twenty-five companies were identified, but only seven were identified as having the capability, potential excess capacity, and interest in AETC requirements. The available excess capacity among the seven companies could not be determined. Only two companies were able to provide estimated costs and available capacity in compliant facilities. A solicitation response may be substantially more responsive.

Alternative 6 is the HQ AETC/LGM selected option. It is a variation of alternative three, since no source for outsourcing had been identified. A 25-year lifecycle cost assessment of each alternative was prepared. The preferred alternative based on total cost is alternative 3. Alternative 6 was not costed in the report due to implementation schedule options. The alternatives and cost may be found summarized in Table 4.

**Table 5**

| Base | Facility Number | Number of Bays Existing | Number of Bays New | Capacity (fday/year) | AETC Workload Total (fday/year) | Capacity Excess/ Shortfall (+/-) (fday/year) |
|---|---|---|---|---|---|---|
| Altus | New Facility | NA | 1 | 232 | 161 | 71 |
| Columbus | Building 262 and New Facility | 1 | 2 | 696 | 696 | 0 |
| Kirtland | New Facility | NA | 1 | 232 | 222 | 10 |
| Laughlin | Building 51 and New Facility | 1 | 2 | 696 | 698 | -2 |
| Little Rock | New Facility | NA | 1 | 232 | 221 | 11 |
| Luke | Building 922 | 2 | NA | 348 | 348 | 0 |
| Randolph | Building 48 | 1 | NA | 232 | 232 | 0 |
| | New Facility #1 | NA | 1 | 232 | 208 | 24 |
| | New Facility #2 | NA | 1 | 232 | 226 | 6 |
| Sheppard | Building 2402 | 1 | NA | 232 | 233 | -1 |
| Tyndall | Building 315 | 1 | NA | 232 | 231 | 1 |
| Vance | Building 192 | 1 | NA | 232 | 232 | 0 |
| Total | | 8 | 9 | 3,828 | 3,708 | 120 |

HQ AETC/LGM decided that it could only support the addition of a 2-bay paint hangar for small aircraft at Laughlin and Columbus AFBs and one medium-bay paint facility at Randolph AFB. The cost for these three projects is projected as shown in Table 6. Aircraft corrosion control workload would be regionalized at these facilities by moving aircraft from Vance, Sheppard, Luke, and Laughlin AFBs.

**Table 6**

| Base | Type of Facility | MILCON Cost Est |
|---|---|---|
| Laughlin AFB | 2-Bay Hangar (Small) | $4.8M |
| Columbus AFB | 2-Bay Hangar (Small) | $4.8M |
| Randolph AFB | 1-Bay Hangar (Medium) | $7.5M |

In conclusion, the Regionalization Study was a beneficial planning tool for AETC. The team development of the aircraft corrosion control concept of the 'flowday' has become the key in corrosion control facility planning. This tool will allow for a much better understanding of the individual base requirements. The utilization of the 25-year facility present worth cost will more clearly define the true cost of business. The present worth cost of a facility allows the commander to make a more informed decision about the cost of adding a new facility. No longer is the decision solely based on the construction and design cost of a facility.